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STENELMIS LIGNICOLA AND *STENELMIS XYLONASTIS*, TWO NEW NORTH AMERICAN SPECIES OF WOOD-INHABITING RIFFLE BEETLES (COLEOPTERA: ELMIDAE)

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Abstract.—Adults of two new species of Nearctic *Stenelmis* are described. Both occur throughout much of the lower Midwest, Gulf Coast, and Atlantic Coast states. Adults of **S. lignicola** and **S. xylonastis** typically live in medium to large, warm, sandy rivers where they are found most often on submerged wood. Males of both species lack the spinous mesotibial ridge that occurs on males of nearly all other Nearctic *Stenelmis.* These species are structurally similar to each other and several described species, which has caused confusion in recent literature; emendations of literature records are provided when voucher specimens were available.

Key Words: Elmidae, *Stenelmis,* new species, Nearctic, riffle beetles

As part of a revisionary study of the riffle beetle genus *Stenelmis* in North America (Schmude and Hilsenhoff, in prep.), two new species are described herein. Both are broadly distributed throughout most of the southeastern United States, and are structurally similar to several described species, as well as to each other. Consequently, several publications have mentioned one or the other species (see below), often as misidentifications.

Adults of *S. lignicola* were identified as *S. convexula* Sanderson by Brown (1956), Sanderson and Brown (1959), and White (1980, in part, not all of the specimens were available for study), and as *S. markelii*(*sic*) Motschulsky by Finni and Skinner (1975, in part, not all of the specimens were available for study). Patrick (1961) and Patrick et al. (1967) identified *S. lignicola* as two and seven different species, respectively. Young (1954) identified some specimens of *S. xylonastis* as *S. convexula,* and Barr and Chapin (1988) identified them as *S. bicarinata* LeConte.

Males of both species lack a spinous ridge on the inner margin of the mesotibia, a secondary sexual character that is present on males of all other Nearctic species except *S. sinuata* LeConte; Brown's (1972: 34) statement that males of *S. convexula* lack this structure was in error. The absence of this character was first noticed by Burke (1963), who identified *S. xylonastis* as *Stenelmis* sp. Based primarily on the absence of a mesotibial ridge, adults of both new species were thought to be the "true" *S. bicarinata* by Brown (1987). Schmude and Hilsenhoff

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(1991) corrected this confusion and stated that the two new species would be described later; this article is the follow-up paper to their statement.

Materials and Methods

The following institutions and individuals provided specimens for this study: AMNH—American Museum of Natural History, New York, L. H. Herman; ANSP—Academy of Natural Sciences of Philadelphia, D. Azuma; CASC—California Academy of Sciences, San Francisco, D. H. Kavanaugh, R. Brett; CDFA—California Dept. of Food and Agriculture, Sacramento, F. G. Andrews; CLEM—Clemson Univ., Clemson, M. C. Heyn, K. M. Hoffman; CMNH—Carnegie Museum of Natural History, Pittsburgh, J. E. Rawlins; CNCI—Canadian National Collections, Ottawa, L. LeSage; DPIC—Duke Power Company, Huntersville, NC, K. L. Manuel; FAMU—Florida A&M Univ., Tallahassee, R. W. Flowers; FSCA—Florida State Collection of Arthropods, Gainesville, M. C. Thomas; IMNH—College of Idaho Museum of Natural History, Caldwell, W. H. Clark; INHS—Illinois Natural History Survey, Champaign, K. C. McGiffen, K. R. Methven; LSUC—Louisiana State Univ., Baton Rouge, J. B. Chapin, C. B. Barr; MDEQ—Mississippi Dept. of Environmental Quality, Pearl, M. C. Beiser; MSEM—Mississippi Entomological Museum, Mississippi State, T. L. Schiefer; MSUC—Michigan State Univ., Lansing, R. L. Fischer; MCZC—Museum of Comparative Zoology, Harvard Univ., Cambridge, S. P. Shaw, D. Furth, S. Pratt; NCST—North Carolina State Univ., Raleigh, R. L. Blinn; NMNH—National Museum of Natural History, Smithsonian Institution, P. J. Spangler; PERC—Purdue Univ., West Lafayette, A. V. Provonsha, D. W. Bloodgood; RUIC—Rutgers Univ., New Brunswick; SEMC—Snow Entomological Museum, Univ. of Kansas, Lawrence, G. W. Byers, R. W. Brooks, J. Pakaluk, J. K. Gelhaus; TAMU—Texas A&M Univ., College Station, H. R. Burke, E. G. Riley; UAIC—Univ. of Alabama, Tuscaloosa, A. C. Benke; UDIC—Univ. of Delaware, Newark, R. W. Lake; UGAM—Univ. of Georgia Museum of Natural History, Athens, C. L. Smith; UKEC—Univ. of Kentucky, Lexington, P. H. Freytag; UMIC—Univ. of Mississippi, University, P. K. Lago; UMMZ—Univ. of Michigan, Ann Arbor, M. F. O'Brien; UMRM—Univ. of Missouri, Columbia, R. L. Blinn, K. B. Simpson; CBB—Cheryl B. Barr, California State Univ., Sacramento; HPB—Harley P. Brown, Oklahoma Museum of Natural History, Norman; MBG—Michael B. Griffith, West Virginia Univ., Morgantown; KLS—Kurt L. Schmude, Univ. of Wisconsin, Madison; WDS—William D. Shepard, California State Univ., Sacramento; DKY—Daniel K. Young, Univ. of Wisconsin, Madison.

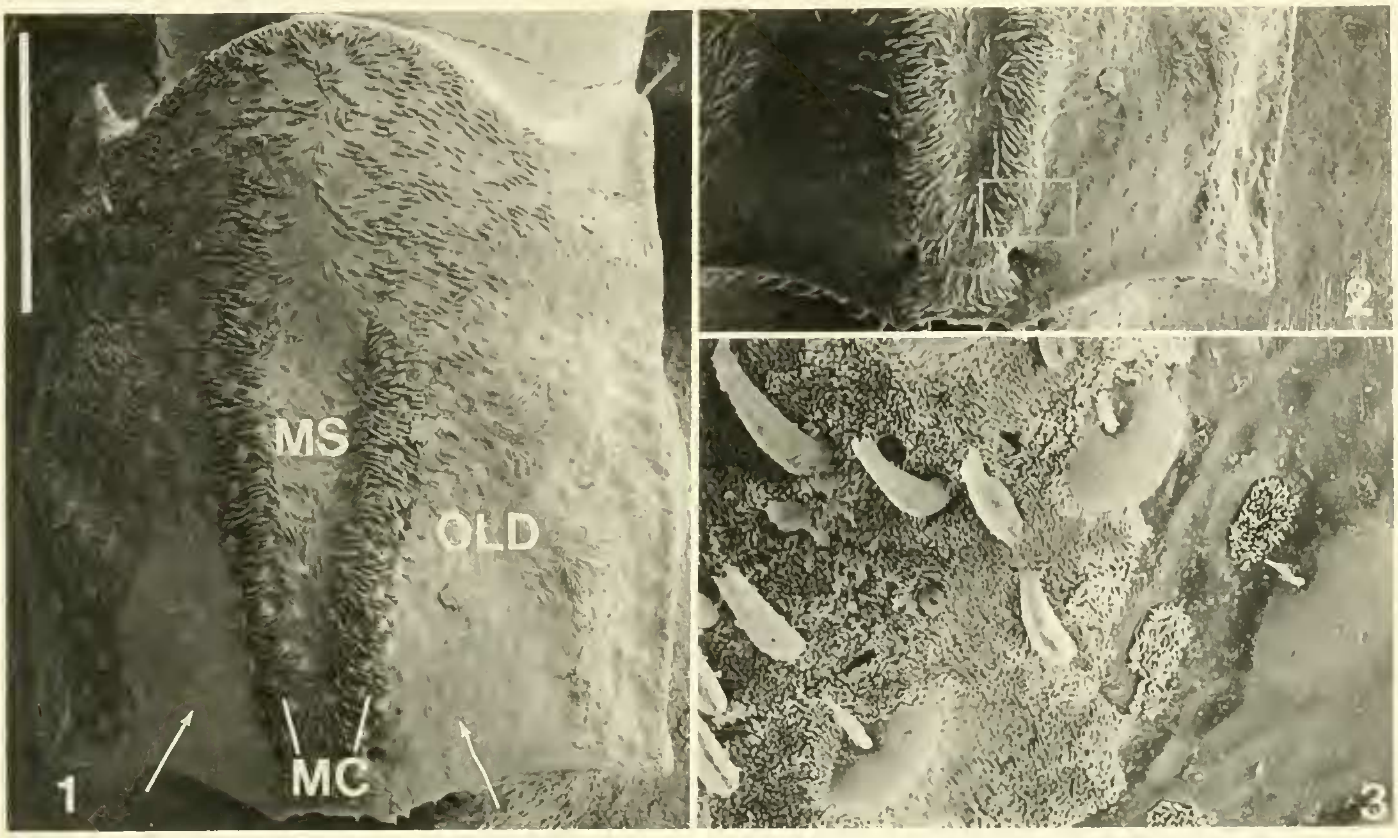
Scanning electron microscope (SEM) micrographs were made using an Hitachi S-570 SEM. Measurements were made at 72× or 144× (for comparative genitalic measurements) with an ocular micrometer on a Leitz dissecting microscope. The following abbreviations and explanations of pronotal structures and measurements are used in the text and Tables 1 and 2. Pronotal structures: **MS**—median sulcus, **MC**—median costae, **OLD**—oblique lateral depression. Measurements: **IOW**—minimum interocular width; **PL**—maximum length of pronotum measured along meson; **PW**—maximum width of pronotum; **PW/PL**—ratio of pronotal width vs. length; **EL**—maximum length of elytra measured from anterior margin to apex along elytral suture with beetle's venter resting on horizontal plane; **EW**—maximum width of elytra; **EL/EW**—ratio of elytral length vs. width; **PE Length**—length of pronotum and elytra, measured separately, and summed. U.S. Postal Service abbreviations for states are used in the Distribution and Habitat sections under each species.

Table 1. Variation of six mensural characters (in mm) and their ratios for adults of *Stenelmis lignicola* throughout its range. M = male, F = female; definitions for other abbreviations found in Methods section.

Locality	n	PL	PW	PW/PL	EL	EW	EL/EW	PE Length	IOW
OK	M 21	0.83–1.00	0.73–0.84	0.83–0.92	2.00–2.31	1.04–1.15	1.84–2.01	2.83–3.24	0.33–0.36
pooled	F 18	0.84–0.96	0.74–0.88	0.84–0.91	2.03–2.30	1.04–1.20	1.89–2.00	2.88–3.26	0.34–0.38
AL type	M 12	0.84–0.91	0.74–0.84	0.84–0.92	1.98–2.25	1.05–1.16	1.79–1.94	2.81–3.16	0.34–0.38
series	F 19	0.86–0.98	0.75–0.88	0.86–0.91	2.00–2.31	1.03–1.21	1.83–1.99	2.86–3.29	0.34–0.40
MS to NC	M 58	0.76–0.98	0.68–0.88	0.83–0.93	1.83–2.31	0.98–1.28	1.80–1.95	2.59–3.29	0.31–0.40
pooled	F 58	0.83–1.00	0.71–0.91	0.84–0.95	1.88–2.40	0.98–1.28	1.81–2.00	2.71–3.36	0.35–0.41
D.C., DE	M 3	0.85–0.94	0.74–0.80	0.85–0.87	1.96–2.11	1.06–1.14	1.85–1.91	2.84–3.05	0.35–0.38
pooled	F 12	0.85–0.98	0.76–0.85	0.85–0.90	1.96–2.33	1.04–1.20	1.85–1.98	2.81–3.29	0.34–0.39
KS to KY	M 39	0.85–0.94	0.74–0.84	0.82–0.90	2.08–2.30	1.09–1.20	1.83–1.96	2.94–3.24	0.33–0.38
pooled	F 48	0.89–0.99	0.76–0.89	0.85–0.92	2.08–2.35	1.10–1.24	1.86–2.01	2.96–3.33	0.35–0.40

Table 2. Variation of six mensural characters (in mm) and their ratios for adults of *Stenelmis xylonastis* throughout its range. Abbreviations as in Table 1.

Locality	n	PL	PW	PW/PL	EL	EW	EL/EW	PE Length	IOW
TX, type	M 50	0.84–0.98	0.73–0.84	0.81–0.91	1.99–2.28	1.04–1.18	1.89–2.03	2.83–3.25	0.33–0.39
series	F 50	0.89–1.01	0.76–0.88	0.81–0.89	2.04–2.35	1.04–1.21	1.86–2.04	2.94–3.36	0.35–0.40
OK, TX	M 42	0.81–1.01	0.71–0.83	0.81–0.89	1.90–2.33	1.00–1.18	1.86–2.01	2.71–3.34	0.33–0.40
pooled	F 49	0.88–1.04	0.74–0.89	0.81–0.88	2.04–2.44	1.03–1.26	1.87–2.04	2.91–3.48	0.34–0.43
LA to FL	M 54	0.83–1.00	0.69–0.89	0.82–0.91	1.95–2.38	1.01–1.24	1.85–2.00	2.78–3.38	0.33–0.41
pooled	F 59	0.91–1.05	0.74–0.93	0.80–0.88	2.14–2.51	1.08–1.30	1.83–2.09	3.08–3.54	0.35–0.43
GA to NC	M 32	0.88–1.01	0.70–0.91	0.80–0.93	2.05–2.35	1.04–1.25	1.82–1.98	2.93–3.35	0.33–0.40
pooled	F 17	0.95–1.09	0.80–0.96	0.83–0.91	2.23–2.48	1.13–1.30	1.88–2.01	3.20–3.56	0.38–0.44
VA to DE	M 4	0.90–0.98	0.81–0.86	0.88–0.92	2.18–2.30	1.14–1.23	1.85–1.92	3.08–3.28	0.38
pooled	F 18	0.91–1.08	0.79–0.95	0.83–0.89	2.09–2.49	1.08–1.30	1.88–1.99	3.00–3.56	0.36–0.45
IN, MO	M 22	0.86–0.95	0.73–0.83	0.82–0.89	2.06–2.28	1.06–1.19	1.85–1.96	2.93–3.21	0.35–0.39
pooled	F 29	0.90–1.01	0.75–0.89	0.80–0.89	2.11–2.34	1.10–1.26	1.84–1.98	3.04–3.34	0.35–0.41



Figs. 1–3. *Stenelmis lignicola* pronotum (dorsal view); bar = 0.30 mm; Alabama specimen. 1, MC—median costae; MS—median sulcus; OLD—oblique lateral depression; arrows point to dark basomesal triangles. 2, Rectangle delineates enlarged portion shown in Fig. 3. 3, Surface at 1000×, shows microtrichial layer and large setae on median costa (left) and absence of layer and large setae on basomesal triangle (right).

***Stenelmis lignicola* Schmude and Brown, New Species**

Stenelmis convexula Brown 1956: 38; Sanderson and Brown, 1959: 67; White, 1980: 98 (in part).

Stenelmis markelii[*sic*] Finni and Skinner, 1975: 390 (Gibson Co., IN, record).

Stenelmis crenata, S. sulcata Patrick, 1961: 255.

Stenelmis bicarinata, S. convexula, S. crenata, S. decorata (in part), *S. hungerfordi* (in part), *S. sinuata* (in part), *S. sulcata* Patrick et al., 1967: 378–379.

Stenelmis spp. Benke et al., 1984: 40 (in part).

Holotype male.—*Head:* IOW: 0.38 mm. Median dark band between eyes uniform in width, equal in width to each light band at midlength. Antennae and palpi testaceous. Antennae shorter than pronotum.

Pronotum (Figs. 1–3): PL: 0.91 mm, PW: 0.83 mm. Widest slightly posterior to middle, sides gradually narrowed to base; more abruptly narrowed anterior to middle, gradually narrowed to apex. MS relatively short and shallow, posterior portion narrowed, obsolete in anterior 0.27 and posterior 0.15. MC distinct but not prominent, most elevated medially, convergent posteriorly, becoming obsolete at point between anterolateral tubercles, obsolete in anterior 0.42 and posterior 0.11. Lateral tubercles not prominent, separated by shallow OLD. Anterior tubercle round; posterior tubercle somewhat elongate, obsolete well before basal margin. Most pronotal granules large, as large as largest femoral granules (a few on posterior surface of MC slightly smaller), relatively dense and evenly distributed over entire surface, though obscured in dark areas. Color mostly gray, granules piceous; two basomesal triangular areas (see below) each bordered by MC, lateral tubercles, and posterior margin, and anterior portion of MS fuscorufous.

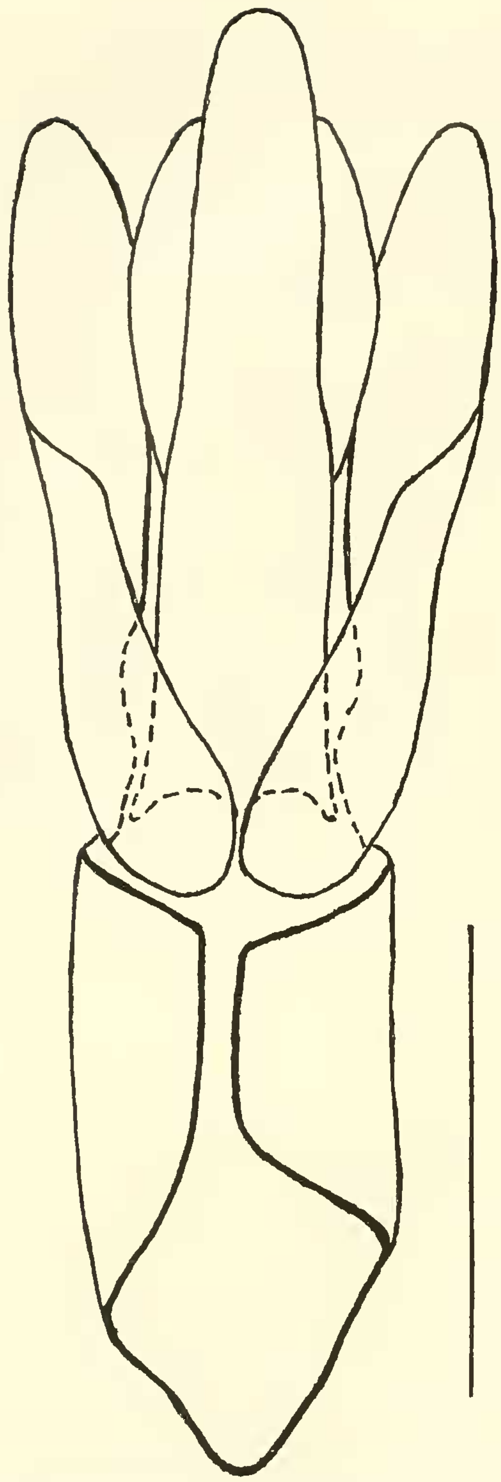


Fig. 4. *Stenelmis lignicola* male genitalia (dorsal view); bar = 0.25 mm; Indiana specimen.

Areas appearing gray when observed by light microscopy are covered with a sheet-like microtrichial layer that is similar to the microtrichial plastron (Spangler and Perkins 1989: 3) and porous plastron layer (Spangler 1990: 2) of the genera *Stenhelmoides* and *Stegoelmis*; structural details of the plastron can only be observed using the SEM. Fuscorufous areas lack the plastron. Figure 3 is an enlarged area of a median costa and a dark basomesal triangle showing the contrasting surfaces.

Scutellum: Six granules present, smaller than pronotal granules.

Elytra: EL: 2.19 mm, EW: 1.16 mm. Low costa on base of interval 3 for 0.15 elytral length, obsolete before reaching basal margin. Background color brown, each elytron bimaculate. Anterior macula not overlapping anterolateral angle (umbone), confined to striae 4–5, slightly longer than costa on interval 3; posterior macula slightly longer than anterior macula, expanded mesally to include stria 3 posteriorly, ending near apex of lateral carina; faint hint of vitta on interval 5 connecting maculae.

Venter: Apical emargination of last sternum relatively wide and deep, but narrower than apical width of metatarsomere 5.

Legs: Granules on femur dense, evenly scattered and of two disparate sizes, with smallest ones less than half size of largest granules. Femur and tibia gray, apex of femur and apex and base of tibia slightly testaceous, tarsus testaceous. Inner margin of meso- and metatibia without spinous ridge. Tarsomere 5 narrow in basal half with margins subparallel, next quarter dilated, apical quarter subparallel; apex 3.0× wider than base; longer than preceding four tarsomeres combined by 0.11 mm in protarsus, 0.13 mm in mesotarsus, 0.09 mm in metatarsus; apicoventral margin weakly convex.

Genitalia (Fig. 4): Penis: widest at base, gradually narrowed to middle, very slightly widened to near apex, then slightly narrowed to its broad and weakly pointed apex; lateral process narrow (0.30 width of narrowest medial point of penis) and arcuate, extending from just basal to narrowest portion of penis to point even with apices of parameres. Parameres: lengths of basodorsal and apicodorsal portions subequal; each inner dorsal margin progressively divergent from base toward outer margin with apical angle rounded and obtuse; outer margins subparallel, slightly convergent at their apices; apices evenly rounded; each inner ventral margin arcuate from apex to near base, then abruptly arcuato-emarginate.

Allotype.—IOW: 0.39 mm, PL: 0.93 mm, PW: 0.81 mm, EL: 2.19 mm, EW: 1.13 mm. Median dark band on head slightly wider than each light band; antennae and pronotum equal in length. Anterolateral margins of pronotum subparallel to apices; all pronotal and scutellar granules as large as largest femoral granules. Costa on interval 3 is 0.17 length of elytra; background color dark brown; posterior macula ending before apex of elytral carina.

Variation.—Within the type series, the antennae of many specimens are longer than the pronotum. The dark basomesal triangles on the pronotum are slightly reduced in some adults. Scutellar granules number 5 to 13. One male has vittate elytra with the medial portion of each vitta faint, narrow and confined to interval 5. Elytral maculae on other specimens are shorter than those on the holotype, being shorter than the costa on interval 3; on two specimens the anterior maculae include part of interval 4; the costae are slightly more pronounced and extend up to 0.20 length of elytra on a few beetles. Tarsomere 5 is longer than the preceding four tarsomeres by 0.10–0.13 mm in the pro- and mesotarsi and by 0.06–0.11 mm in the metatarsus.

Adults from other areas exhibit additional variation. The anterolateral margins of the pronotum are subparallel, convergent, or slightly divergent; the MC are less or more elevated, and obsolete in the anterior 0.37–0.42; the MS is obsolete in the posterior 0.11–0.15; the dark basomesal triangles are rufous to piceous and frequently reduced and crescent-shaped (infrequently absent), especially in specimens from southeastern areas. The elytral costa on interval 3 is quite low to moderately elevated and extends 0.20 the elytral length; the background color is light brown to black; the maculae are very faint to essentially absent. Specimens from Indiana have maculae that are frequently more extensive, expanding to interval 4 anteriorly and stria 3 posteriorly, or even narrowly vittate. In general, northern specimens have more extensive elytral markings and southern individuals are more frequently immaculate. Tarsomere 5 is longer than the preceding four tarsomeres by 0.04–0.11 mm in the metatarsus. The penis is infrequently evenly narrowed from its base to its apex, which is most commonly broad and round; the lateral process is as great as 0.44 the width of the penis; the outer anterior margins of the parameres are slightly arcuate.

Individuals from some populations in southeastern areas of North Carolina to northern Florida, exhibit even greater, but seemingly local, variation. Pronotal granules are smaller than the typically large granules on most individuals; they are as large as or slightly smaller than the largest femoral granules, which are themselves smaller than the typically large femoral granules; the two different sizes of femoral granules are much closer in size to each other. Elytral maculae are more difficult to discern and the elytra are commonly immaculate.

Type data.—*Holotype, allotype, 9 paratypes:* ALABAMA: *Jefferson Co.,* Vestavia Hills, 18 July 1981, T. King, black light trap (holotype with additional label: "mesotarsomere 5 on point, metatarsomere 5 in microvial"). Additional designated paratypes have the following label data: ALABAMA: *Jefferson Co.,* Birmingham, 16 July 1977, T. King, at light (n=15); ibid except 16 June 1978 (n=5). The holotype, allotype, and 4 paratypes will be deposited in the NMNH. Additional paratypes will be in the following collections: 3 INHS, 2 CASC, 2 CNCI, 2 FSCA, 2 SEMC, 2 TAMU, 1 LSUC, 1 MCZC, 1 NCST, 1 MSEM, 1 UGAM, 2 Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Mexico, D.F. (UNAM), 3 HPB, 2 KLS.

Additional specimens examined.—An additional 3512 specimens were examined. Following each collection record, the numbers of individuals are in parentheses and immediately precede the depository institution or private collection, which are abbreviated as in the materials section. Dates and collectors are omitted. Counties or parishes for each state are in italics. **Alabama.** *Colbert* Sheffield (3 FSCA). *Hale* nr Payne Lake, S Duncanville (11 MSUC; 3 KLS). *Jefferson* Birmingham (2 HPB). *Lee* Auburn (2 NMNH). *Montgomery* Montgomery (2 NMNH). *Shelby* Montevallo (25 HPB). *St. Clair* (1 HPB). Springville (3 HPB). *Walker* Jasper (2 HPB). **Delaware.** *New Castle* West Creek, Newark (8 KLS). **District of Columbia.** (2 CMNH). **Florida.** *Calhoun* Chipola R., Scotts Ferry (28 FAMU). Torreya St. Pk. (4 MSEM; 1 KLS). *Gadsden* Chattahoochee (2 FSCA). Quincy (2 NMNH). *Jackson* bluff W Jim Woodruff Dam (42 UMMZ). FL Caverns St. Pk. (2 LSUC; 2 CBB). Spring Lake (158 MSEM; 33 KLS). *Liberty* Apalachicola R., Bristol (3 FAMU). *Okaloosa* Yellow R., Crestview (180 HPB; 21 KLS). *Santa Rosa* NW Holt (8 UGAM). Jay (1 FSCA). W. FL Exp. Sta. (2 FSCA). **Georgia.** *Bibb* GA For. Comm. Sta. (3 HPB). SE Macon (5 CDFA; 1 NMNH). *Brantley* Satilla R. (124 UAIC; 67 KLS). *Brooks* Little R. (3 RUIC). *Burke* Savannah R. (3 HPB), N Upper Three Runs Cr. & Hancock Land. (4 UGAM). *Calhoun* E Leary (1 FSCA). *Charlton* Okefenokee Natl. Widlf. Ref., Stephen Foster cmpgrd. (1 INHS). *Clarke* (1 UGAM). Athens & Whitehall For. (2 FSCA; 11 UGAM; 7 HPB; 4 KLS; 1 WDS). *Cook* Reed Bingham St. Pk. (1 UGAM). *Decatur* Mosquito Cr. (3 FSCA). *De Kalb* Dunwoody (9 FSCA; 2 HPB). *Dougherty* Flint R., Radium Springs (4 ANSP; 1 INHS). *Effingham* Ogeechee R. (145 UAIC; 125 KLS). Savannah R., nr Ebenezer Cr. (13 UGAM; 1 KLS). *Fulton* Bolton (1 UGAM). College Park (71 UKEC; 15 KLS). *Hart* Nuberg (2 FSCA). *Jackson* S Arcade (4 UGAM). *Lowndes* Valdosta (1 UMMZ). *Macon* Flint R. (5 HPB). *Monroe* N Forsyth (2 NMNH). *Montgomery* N Uvalda (10 UGAM; 2 KLS). *Morgan* S Rutledge (2 UGAM). *Pierce/Ware* Satilla R. (194 UAIC; 253 KLS). *Richmond* Savannah R., at Butler Cr., Fifth Str. Land. & N Rae Cr. (21 UGAM; 3 KLS). *Toombs* Altamaha R., Hwy 1 (21 HPB). *Ware* Satilla R., Waycross (6 SEMC). **Illinois.** (1 CMNH). *Adams* Quincy (2 INHS). *Champaign* Champaign (3 INHS). Mahomet, Nettie Hart Woodland Mem. (6 INHS). Urbana (1 INHS). **Indiana.** (3 CASC; 6 NMNH in Casey Coll.). *Gibson* White R., Cunningham's Ferry, NW Patoka (14 PERC; 4 KLS). *Howard* (4 LSUC). *La Porte* La Porte (1 CMNH). *Lawrence* E. Fk. White R. (1 HPB). *Marion* Indianapolis (1 FSCA). *Martin* Shoals (1 INHS). *Monroe* Bloomington (7 AMNH; 4 CASC; 1 CDFA; 4 CMNH; 78 FSCA; 8 IMNH; 5 LSUC; 2 MCZC; 12 MSEM; 2 MSUC; 4 PERC; 41 NMNH; 5 SEMC; 25 UMMZ; 50 HPB; 37 KLS). *Orange* W. Baden Springs (3 CASC; 1 KLS). *Pike* White R. (12 HPB). *Shelby* Shelbyville (3 CNCI). *Tippecanoe* Lafayette (1 CMNH). *Vanderburgh* Evansville (2 INHS; 4 NMNH; 4 UMRM). **Iowa.** (4 SEMC). *Des Moines* Burlington (2 MCZC; 4 RUIC). **Kansas.** *Douglas* (1 SEMC). Lawrence (2 CMNH). *Riley* (2 SEMC). **Kentucky.** *Fayette* Lexington (1 KLS). *Jefferson* Louisville (3 NMNH). *McLean* Green R., SE Calhoun (1 ANSP). **Michigan.** *Kalamazoo* Gull L. Biol. Sta. (1 MSUC). **Mississippi.** *Lafayette* Oxford (2 HPB). **Missouri.** St. Louis (1 MCZC). *Dunklin* Kennett (1 MSEM). *Wayne* Williamsville (8 INHS; 6 KLS). **North Carolina.** Fort Bragg (1 CASC). *Bladen* Cape Fear R., S Tolar Land. (2 ANSP). Turnbull Cr., S Ammon (2 NCST). *Catawba* Hog Hill (1 FSCA). *Cleveland* Shelby (2 NCST; 1 KLS). *Columbus* Waccamaw R. (77 KLS). *Craven* Neuse R., Streets Ferry (5 KLS). *Cumberland* Rockfish Cr. (12 KLS). *Durham* Durham, Duke Univ. For. (4 CDFA). Little R. (1 KLS). *Edgecombe* Tar R. (34 KLS). SW Tarboro (1 MSEM). *Granville* Oxford (3 NCST). *Lenoir* Neuse R., Kinston (99 KLS). *Montgomery* W. Fk. Little R., W Ether (1 INHS). *Moore* Southern Pines (2 NMNH). *Pitt* Tar R., Grimesland (2 KLS). *Robeson*

Lumber R., nr Maxton (83 KLS). Shoeheel Cr. (7 KLS). *Rutherford* Broad R. (9 KLS). *Sampson* Black R. (34 KLS). *Scotland* Lumber R., Wagram (27 KLS). *Wake* Raleigh (1 CNCI; 71 NCST; 1 NMNH; 16 HPB; 12 KLS). **Ohio.** (1 AMNH). **Oklahoma.** *Atoka* Clear Boggy Cr. (4 HPB). *Bryan* Blue R., Armstrong & nr Kenefic (233 HPB; 38 KLS), E Reagan (1 WDS). Bokchito Cr. (2 HPB). *Johnston* (2 HPB). Blue R., Wapanucka (17 HPB). Pennington Cr., Tishomingo & Devil's Den (75 HPB; 3 WDS). Reagan (4 HPB). **Pennsylvania.** *Westmoreland* Jeannette (5 CMNH). **South Carolina.** Savannah R. (345 ANSP; 98 INHS; 1 HPB; 9 KLS). *Aiken* (20 INHS). Savannah R., at Upper Three Runs Cr. & Stevens Cr. (236 UGAM; 21 KLS). Upper Three Runs Cr. (5 ANSP), Savannah R. Plant (2 CLEM; 3 KLS). *Allendale* Savannah R., N Lower Three Runs Cr. (20 UGAM; 3 KLS). *Anderson* Anderson (1 INHS). Portman Shoals (5 TAMU). *Calhoun* Congaree R., nr Lexington-Calhoun Co. line (144 ANSP). *Florence* Florence (2 CLEM). *Greenwood* Greenwood (1 SEMC). *Kershaw* Wateree R., nr Camden (20 ANSP). *Oconee* Whitewater R., Jocassee (1 INHS). *Orangeburg* Edisto R., nr Orangeburg (1 ANSP). S Fk. Edisto R., nr CSX railroad bridge & Roberts Swamp (29 DPIC; 10 KLS). *Pickens* Clemson (6 AMNH; 3 CLEM; 63 MSUC; 1 HPB; 8 KLS; 28 DKY). **Virginia.** James R., Sta. 1 (4 ANSP). **Mexico.** Tamaulipas, Punta Piedras (1 MSEM).

Distribution (Fig. 5).—*Stenelmis lignicola* is a common species in the Southeast from northern parts of MS and FL to NC; it is uncommon further north into DE. It is apparently absent from the western Gulf Coast states; Barr and Chapin (1988) did not collect any adults during their extensive study in LA. Besides being apparently locally abundant in OK, and the extensive light trap collections made by F. N. Young in IN, this species is uncommon but widespread in the lower Midwest states. Five specimens of this species and one of *S. xylonastis,* supposedly collected in Jeannette, PA by H. G. Klages (circa 1900), were initially believed to be doubtful range extensions. In later correspondence, J. E. Rawlins (CMNH—curator) stated that although the majority of specimens in the H. G. Klages Collection are correctly labeled, he knows for certain that some individuals are suspect. This fact further supports our doubts about the validity of the specimens' locality labels, although it is possible both species occur (or occurred) in the large rivers around Pittsburgh, PA. Also, one specimen of *S. lignicola,* light-trapped by the late W. H. Cross (MSEM) supposedly in Punta Piedras, Tamaulipas, Mexico, was examined. This record is a significant southwestern extension to the apparent distribution of *S. lignicola* and is considered questionable.

Habitat.—This species is apparently a strict inhabitant of wood, although it is occasionally collected on rocky substrates where it is probably a transient. It occurs chiefly in medium to large, warm, sandy, and often blackwater rivers. Benke et al. (1984) listed *Stenelmis* spp. in their study of the Satilla R., GA; adults were found exclusively on submerged wood, and *S. lignicola* was the most abundant species among their voucher specimens. Adults were found year around in rivers in SC (Patrick et al. 1967) and GA (Benke et al. 1984), and this is probably the case throughout its range. Adults are readily attracted to lights during their dispersal flights. Flight records for the Midwest (MO to KY) include 25 June–5 Sept., while records for the Southeast (AL to NC) are 19 May–9 Oct.

Etymology.—Latin, *ligni* (wood), and *cola* (inhabitant).

Stenelmis xylonastis Schmude and Barr, New Species

Stenelmis sp. (*Sinuata-Humerosa* Group, apparently near *convexula* Sanderson and *märkelii* Motschulsky) Burke, 1963: 113.
Stenelmis bicarinata Barr and Chapin, 1988: 136.

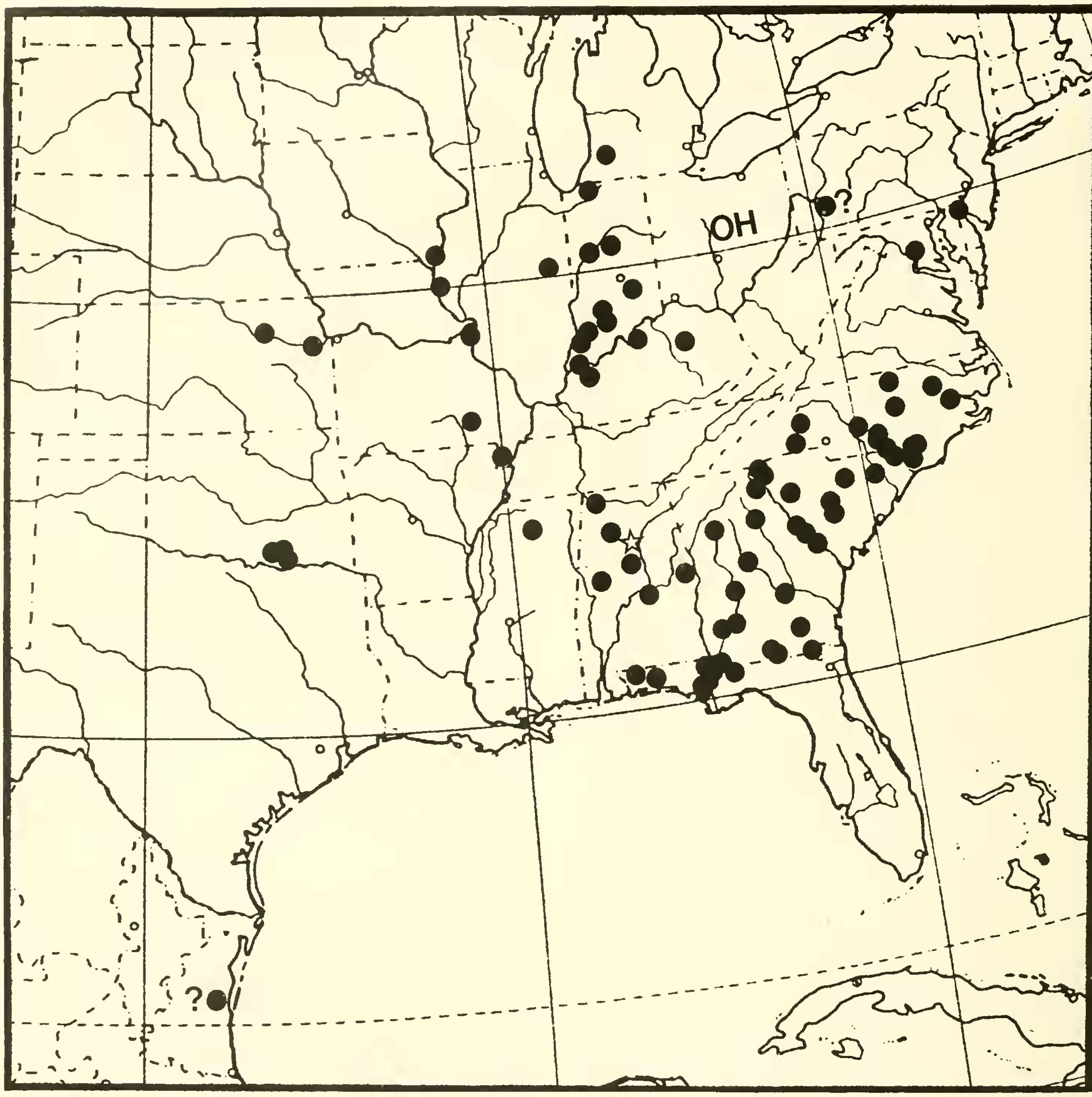


Fig. 5. Distribution of *Stenelmis lignicola*. Star: type locality. OH: a single Ohio record with no further locational details. Pennsylvania and Mexico records are questionable, see section on distribution.

Stenelmis convexula Young, 1954: 214 (in part).

Holotype male.—*Head:* IOW: 0.35 mm. Median dark band between eyes uniform in width, equal in width to each light band at midlength. Antennae and palpi testaceous. Antennae shorter than pronotum.

Pronotum (Fig. 6): PL: 0.91 mm, PW: 0.74 mm. Widest slightly posterior to middle, sides narrowed toward base with a slight sinuation before base; abruptly narrowed anterior to middle, feebly divergent and sinuate to apex. MS distinct, widest and deepest anteriorly, gradually narrowed and shallower toward base. MC low anteriorly, most elevated anterior to posterolateral tubercles, slightly less elevated toward base. MS and MC obsolete in anterior 0.27 and posterior 0.07. Lateral tubercles relatively prominent and separated by shallow OLD that is deepest mesad to posterior tubercle. Anterior tubercle small and round; posterior tubercle weakly and narrowly costate posteriorly, but obsolete well before basal margin. Granules small, slightly smaller than largest femoral granules, uniform in size, sparsely and uniformly scattered over surface, not readily visible in dark areas. Color mostly gray; MC, posterior half of MS, and area of pronotum between posterolateral tubercles lighter gray than remaining surface; granules, anterior half of MS, deepest portion of OLD, and narrow mediolateral band along basal margin fuscous.

Scutellum: Fourteen granules, smaller than pronotal granules, scattered over surface.

Elytra: EL: 2.09 mm, EW: 1.09 mm. Low costa on base of interval 3 for 0.18 elytral length, obsolete before reaching basal margin. Background color dark brown, each elytron very faintly bimaculate. Anterior macula not overlapping umbone, confined to striae 4–5, shorter than costa on interval 3; posterior macula about as long as anterior macula, expanded mesally to include interval 4 posteriorly, obsolete before reaching apex of lateral carina.

Venter: Apical emargination of last sternum relatively wide and deep, but narrower than apical width of metatarsomere 5.

Legs: Femur quite granular in appearance, granules uniformly scattered and of two sizes, with smallest ones about half size of largest ones. Femur and tibia light gray, apex of femur more testaceous, tarsus testaceous. Inner margin of meso- and metatibia without spinous ridge. Tarsomere 5 narrow in basal half with margins subparallel, next quarter dilated, apical quarter subparallel; apex 2.7 × wider than base; longer than preceding four tarsomeres combined by 0.11 mm in protarsus, 0.09–0.10 mm in mesotarsus, 0.08 mm in metatarsus; apicoventral margin weakly convex.

Genitalia (Figs. 7–10): Penis: widest at base, gradually narrowed to middle, slightly widened to near apex where it tapers to an acuminate tip; lateral process narrow (0.27 width of penis at its narrowest medial point), and evenly arcuate, extending from point where penis begins to narrow to point even with apices of parameres. Parameres: lengths of basodorsal and apicodorsal portions subequal; each inner dorsal margin progressively divergent from base toward outer margin with apical angle smooth and obtuse; outer margins subparallel in basal half, slightly arcuate in apical half; apices evenly rounded; each inner ventral margin arcuate from apex to near base, then abruptly arcuato-emarginate.

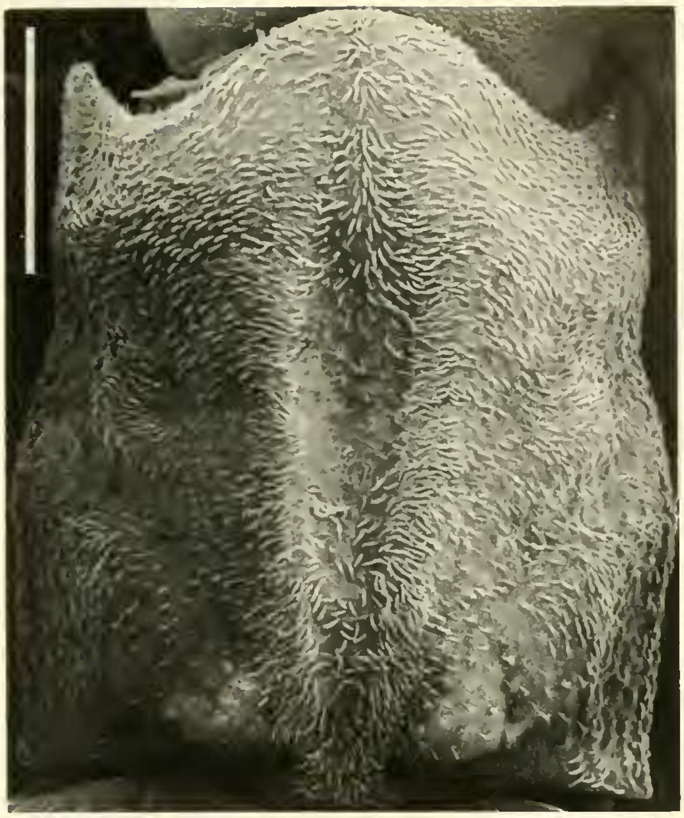
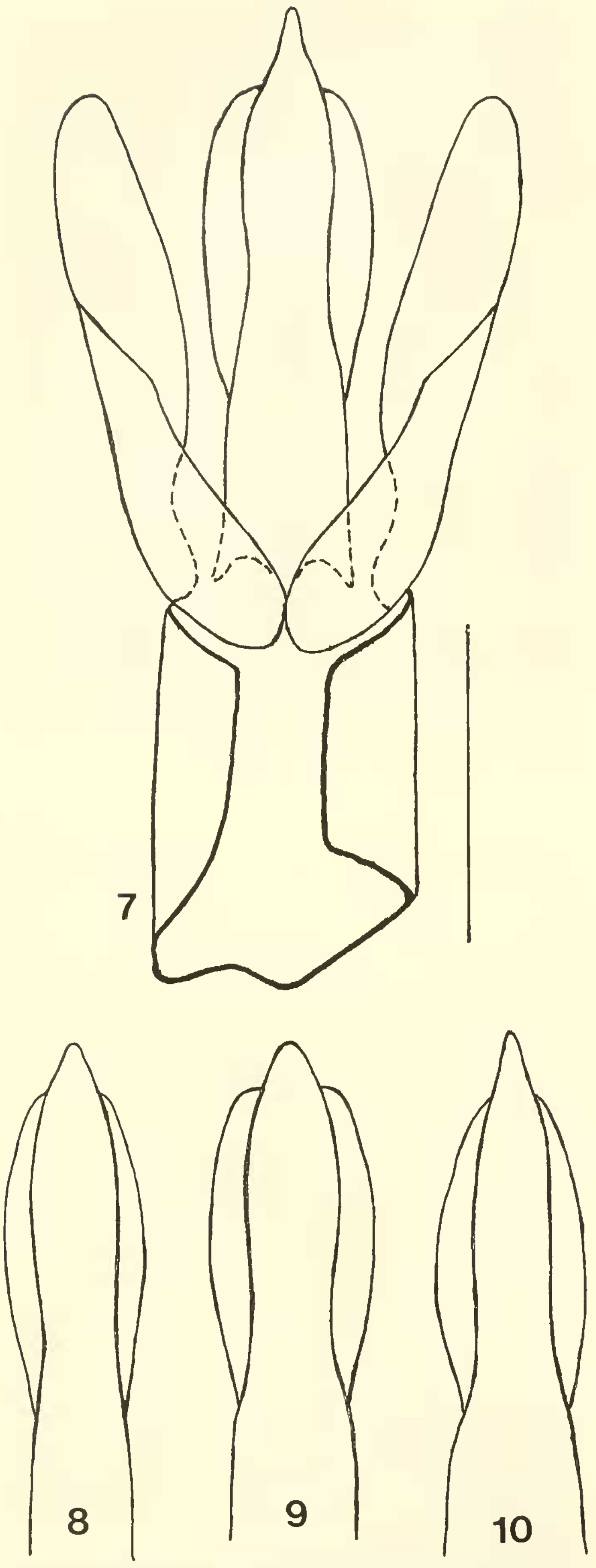


Fig. 6. *Stenelmis xylonastis* pronotum (dorsal view); bar = 0.27 mm; Mississippi specimen.

Allotype.—IOW: 0.36 mm, PL: 0.98 mm, PW: 0.84 mm, EL: 2.23 mm, EW: 1.13 mm. Essentially similar to holotype but larger. Apicolateral margin of pronotum sinuate but not divergent; MC most elevated nearer to base (between posterolateral tubercles); OLD shallower; fuscous areas nearly absent. Eight scutellar granules. Tarsomere 5 longer than combined lengths of preceding four tarsomeres by 0.10 mm in protarsus, 0.11 mm in mesotarsus, 0.06 mm in metatarsus; apex 3.0 × wider than base.

Variation.—Minor variation occurs within the type series. In some beetles the lateral margins of the pronotum are not sinuate basally, and the apical portions are subparallel or more divergent and not sinuate; MS and MC are less pronounced and obsolete



Figs. 7–10. *Stenelmis xylonastis* male genitalia showing variability of apex of penis (dorsal view); bar = 0.25 mm. 7, Parameres spread wider than natural; Mississippi specimen. 8, Holotype. 9, Paratype. 10, North Carolina specimen.

in the anterior 0.24–0.28 and posterior 0.08–0.11; fuscous areas are most commonly absent, but some paratypes have expanded fuscous areas that form basomesal triangles as in *S. lignicola*. The elytral maculae are infrequently brighter, and more frequently narrower or obscure with the elytra appearing immaculate. Pro- and mesotarsomere 5 of males and females are 0.08–0.11 mm and 0.06–0.11 mm longer, respectively, than the preceding four tarsomeres combined, while metatarsomere 5 is longer by 0.05–0.10 mm in males and 0.04–0.08 mm in females. The apex of the penis in some males is not as acuminate (Fig. 9).

Variation in individuals elsewhere is minimal. The median dark band on the head is narrower than the lateral light bands. The pronotal MS and MC are obsolete in the anterior 0.23 and posterior 0.05, and the posterolateral tubercle is weakly raised and obovate instead of costate. The scutellar granules are as few as 8. The elytral costa on interval 3 extends 0.14–0.22 the elytral length; the background color is pale brown to black; maculae are commonly bright and infrequently wider with the anterior macula confined to interval 4 to stria 5, and the posterior macula expanded mesally to include interval 3 posteriorly; the anterior macula is sometimes longer than the costa on interval 3; pale markings end at the apex of the lateral carina or slightly beyond. Some adults are vittate with the vittae similarly confined but narrowed to interval 5 medially. The margins of the penis are subparallel anteriorly in some males (Fig. 10); the acuminate apex is even more exaggerated in many males, especially those from Mississippi (Fig. 7).

Adults from populations in eastern North Carolina and South Carolina show greater, yet seemingly isolated, variation. Pronotal granules are larger and more densely distributed than the typically small and inconspicuous granules on most adults; they are as large as the largest femoral granules. The elytral costa on interval 3 nearly reaches the basal margin. Elytral markings may be brighter, maculate to vittate, wider (striae 3–5), and uniform in width. The lateral process is as great as 0.63 the width of the penis.

Type data.—*Holotype, allotype,* 217 *paratypes*: TEXAS: *Grimes Co.,* Navasota, Navasota River, 31 August 1967, H. P. Brown. The holotype, allotype, and 15 paratypes will be deposited in the NMNH. Additional paratypes will be in the following collections: 15 CASC, 15 INHS, 12 SEMC, 7 CNCI, 7 TAMU, 6 MCZC, 4 FSCA, 2 LSUC, 2 UNAM, 2 MSEM, 2 NCST, 2 PERC, 2 UGAM, 2 UMRM, 2 University of Wisconsin-Madison, 12 CBB, 84 HPB, 21 KLS, 3 WDS.

Additional specimens examined.—An additional 2412 specimens were examined. **Alabama.** *Baldwin* Fish R., SW Loxley (2 CBB). *Blount* Blount Springs (3 HPB). Mill Cr. (3 HPB). *Conecuh* Bushy Cr., SW Lenox (3 LSUC; 5 CBB). *Jefferson* Birmingham (2 HPB). Vestavia Hills (4 HPB; 1 KLS). *Mobile* Mobile (6 INHS; 5 MCZC; 5 SEMC, 1 HPB). *Pickens* Reform (1 INHS). *Shelby* Montevallo (48 HPB). *Walker* Jasper (16 HPB). **Arkansas.** *Cleveland* (1 HPB). *Little River* Red R., Ashdown (1 HPB). **Delaware.** *Kent* Tappahanna Ditch, Marydel (1 UDIC). **District of Columbia** (1 NMNH). **Florida.** *Bay* Pine Log Cr. (4 FAMU). *Jackson* bluff W Jim Woodruff Dam (1 UMMZ). *Okaloosa* (1 UMMZ). Blackwater R., NW Holt (1 FSCA; 1 UGAM). Yellow R., Crestview (1 HPB). Shoal R., at Cox Br. (6 FAMU). *Santa Rosa* Blackwater R., NW Holt (5 UGAM; 1 KLS). *Walton* De Funiak Springs (2 CNCI; 4 SEMC; 2 KLS). Turkey Cr., S Florala AL (1 CBB). **Georgia.** Atlanta (1 HPB). *Bibb* GA For. Comm. Sta. (1 HPB). *Clark* Whitehall For. (1 HPB). *Effingham* Ogeechee R. (3 UAIC). *Grady* Spence Mill Cr., NE Spence (16 MBG; 2 KLS). Tired Cr., E Cairo (1 UGAM). *De Kalb* Dunwoody (1 HPB). *Muscogee* Kendall Cr., E Columbus (1 LSUC; 1 CBB). *Richmond* Savannah R., N Rae Creek (3 UGAM). *Toombs* Ohoopee R., Lyons (1 INHS; 1 SEMC). **Indiana.** *Crawford* Grantsburg (1 AMNH; 1 KLS). *Monroe* Bloomington (1 HPB). **Kentucky.** *McLean* Green R., SE Calhoun (5 ANSP). **Louisiana.** Detailed data for the 54 localities listed for LA by Barr and Chapin (1988, under *S. bicarinata*) are all valid and not repeated here. *Allen* Calcasieu R., NW Oberlin (3 CNCI). *E. Baton Rouge* Greenwell Springs (1 CASC; 1 SEMC). *Winn* Winnfield (6 MCZC). **Maryland.** *Prince Georges* Bladensburg (11 NMNH; 1 KLS). Priest Bridge & Riverdale (2 NMNH). **Mississippi.** nr Hattiesburg (1 AMNH). *Adams* E Natchez (2 UMIC; 4 HPB; 2 KLS). *Covington* Lux (8 HPB). Okatoma Cr., Seminary (11 MDEQ). *Forrest* Black Cr., SE Hwy 59 (14 FAMU). Myers Cr. (2 LSUC; 2 CBB; 13 WDS). *George* Lucedale, Dog R. & Cedar Cr. (4 INHS). Pascagoula R., Merrill (2 MDEQ). Whiskey Cr. (1 INHS; 1 SEMC). *Greene* Gaines Cr. (4 INHS). Leaf R., McLain (7 HPB). nr State Line (9 MSEM; 2 UMIC; 3 HPB; 3 KLS). Whiskey Cr., Leaf (4 INHS; 1 SEMC). *Harrison* Biloxi (1 HPB). Gulfport (1 LSUC). Long Beach (1 FSCA). N Lyman (2 UMIC; 1 HPB). *Jackson* Pascagoula R., Big Creek (3 MDEQ). *Jefferson Davis* (18 MSEM; 1 KLS). *Lafayette* Oxford (6 UMIC; 3 HPB; 1 KLS). *Lamar* Black Cr. (23 HPB). Monroe Cr., S Sumrall (1 MDEQ). *Leflore* Greenwood (1 SEMC). *Lowndes* Camp Pratt (2 INHS). Columbus (1 SEMC). *Marshall* Chewalla Lake (1 UMIC). *Monroe* Hamilton (7 SEMC; 1 KLS). *Oktibbeha* Adaton (1 MSEM). Starkville (4 MSEM; 1 KLS). *Pearl River* Wolfe R., Hwy 26 (13 MDEQ). *Perry* Coleman Cr., New Augusta (1 WDS). W McLain (119 HPB; 20 KLS). *Pike* Tangipahoa R., Magnolia (33 HPB). *Pontotoc* SE Ecru (1 MSEM). *Simpson* Strong R., Mendenhall (5 HPB). *Smith* (1 RUIC). *Stone* Black Cr. (10 SEMC; 2 KLS). Red Cr. (1 UMIC; 1 HPB). *Warren* NE Bovina (2 UMIC; 2 HPB). *Wayne* Clara (6 INHS). **Missouri.** *Perry* Mississippi R., dike 100.1R (1 UMRM). *Ripley* Little Black R., W Glenn (3 UMRM; 2 KLS). *Wayne* Williamsville

(60 CNCI; 27 INHS; 57 KLS). **North Carolina.** *Bladen* Cape Fear R., S Tolar Land. (1 ANSP). *Columbus* Juniper Cr. (15 KLS). Waccamaw R. (1 KLS). *Cumberland* Rockfish Cr. (4 KLS). *Edgecombe* SW Tarboro (1 MSEM). *Granville* Oxford (2 NCST; 2 HPB; 1 KLS). *Moore* Lower Little R. (7 KLS). Mill Cr., Lakeview (1 FSCA). *Onslow* Gum Br. (8 KLS). New R. (7 KLS). *Robeson* Shoeheel Cr. (4 KLS). *Scotland* Big Shoeheel Cr. (2 KLS). *Wake* Raleigh (8 NCST; 1 NMNH; 1 HPB; 1 KLS). **Oklahoma.** *Atoka* Caney Cr. (3 HPB). Clear Boggy R. (221 HPB; 20 KLS). *Bryan* Blue R., NW Armstrong & nr Kenefic (40 HPB). Bokchito Cr. (1 HPB). *Cherokee* Terrapin Cr. (1 HPB). *Choctaw* Clear Cr., E Swink (3 HPB). *Coal* Clear Boggy Cr. (101 HPB; 23 KLS). *Johnston* Blue R. (1 HPB). Mill Cr., W Mill Creek (1 HPB). Pennington Cr., Tishomingo (3 HPB). *Latimer* W Red Oak (1 FSCA; 135 HPB; 67 KLS). *Le Flore* Poteau R. (11 HPB), SW Arkoma (1 WDS), Hodgen (25 HPB), E Panama (4 CBB; 9 KLS; 58 WDS). *McCurtain* Clear Cr. (1 HPB). Glover R., NW Broken Bow (3 WDS). Mountain Fk. R., nr mouth (2 HPB), Smithville (1 WDS). Yanubbee Cr., N Broken Bow (2 KLS). *Pontotoc Co.* Buck Cr. (7 HPB). *Pushmataha* Kiamichi R., SE Clayton (3 KLS; 15 WDS). **Pennsylvania.** *Westmoreland* Jeannette, (1 CMNH). **South Carolina.** *Aiken* Savannah R., at Stevens Cr. (1 UGAM). *Florence* Florence (5 CLEM; 4 NMNH). *Kershaw* Wateree R., nr Camden (3 ANSP). *Oconee* Seneca (1 CLEM). *Orangeburg* S Fk. Edisto R., at Roberts Swamp (1 DPIC). **Tennessee.** *Shelby* Loosahatchie R., nr Memphis (1 ANSP). **Texas.** Sabine R. (18 ANSP). *Anderson* Boxes Cr., SW Elkhart (3 INHS; 32 TAMU; 2 HPB). *Bexar* nr Schertz (1 CBB). *Brazos* Cedar Cr. (3 TAMU). College Station (2 TAMU). Navasota R., E Bryan (7 CASC; 6 TAMU). *Jefferson* Neches R., Beaumont (2 ANSP). *Grimes* Navasota R., N Navasota (19 TAMU). *Limestone* Navasota R., Groesbeck (2 HPB). *Montgomery* Sam Houston Natl. For., Stubblefield L. (2 TAMU). W Fk. San Jacinto R., Conroe (43 HPB; 11 KLS). The Woodlands (3 UGAM; 2 TAMU). *Nacogdoches* Angelino R., Douglass (30 HPB; 10 KLS). Lanana Cr. (1 WDS), Nacogdoches (10 WDS). *Polk* Long King Cr., Livingston (2 INHS; 5 TAMU; 4 HPB). *Robertson* Camp Cr. (2 TAMU; 1 HPB). *San Jacinto* Big Cr. Scenic Ar. (3 TAMU). *Walker* San Jacinto R., W New Waverly (31 TAMU; 2 HPB). **Virginia.** Fredericksburg (13 NMNH; 1 KLS). *Fairfax* (1 NMNH). mouth of Difficult Run (1 NMNH).

Distribution (Fig. 11).—*Stenelmis xylonastis* is relatively common across the western Gulf Coast states from western AL to eastern TX, including southeastern OK. It is widespread from northwestern FL to DE, but considerably less common. Its northern limit is in IN, where it is rare. There is one doubtful record from PA (see distribution under *S. lignicola*).

Habitat.—Burke (1963) reported finding this "common elmid . . . on submerged logs," and it appears that it is most often found on submerged wood, although adults were more frequently collected on rocks, debris, submerged tree roots, and aquatic plants than those of *S. lignicola.* In fact, slightly more collections of *S. xylonastis* were made from gravel than wood in LA (unpublished data). It is most prevalent in medium to large, warm, sandy, and often blackwater rivers, but Barr and Chapin (1988) found them in many small, cool, sandy, spring-fed streams. Adults have been found year around in rivers in the Southeast, and this is probably typical throughout its range. During their dispersal flights adults may be readily collected at lights. Our records indicate flight periods from 29 Apr. to 10 Sept. for areas in the Southeast, and from 2 July to 17 Aug. in MO to IN.

Etymology.—Greek, *xylo* (wood), and *nastis* (inhabitant).

Diagnoses.—The two species described in this paper cannot be inserted into the adult keys of Sanderson (1938) and Brown

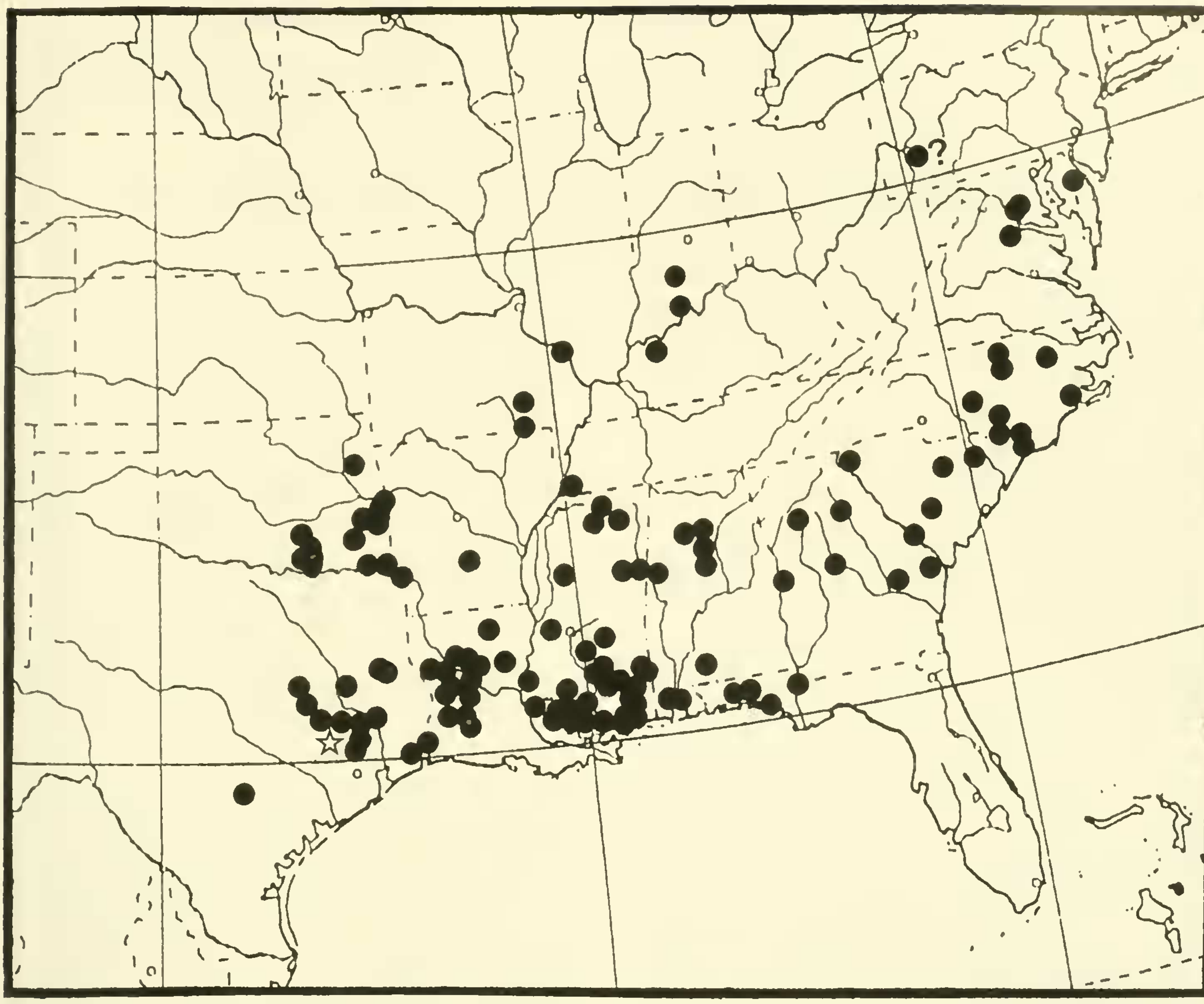


Fig. 11. Distribution of *Stenelmis xylonastis*. Star: type locality. Pennsylvania record is questionable, see section on distribution.

(1972) for the same reasons outlined in Schmude and Brown (1991). Instead, we provide a discussion on distinguishing characters. Both species would be placed in Sanderson's (1938) *sinuata/humerosa* group.

Males of both species can be distinguished from all other species, except *S. sinuata*, by the lack of a spinous mesotibial ridge. An accuminately tipped penis will separate males of *S. xylonastis*; the penes of *S. lignicola* and *S. sinuata* are more similar to each other, but in many *S. sinuata* the penis is wider with the margins straight and not medially sinuate. For *S. lignicola*, the pronotum has large granules, dark basomesal triangles (which may be crescent-shaped or otherwise reduced), and MC that are obsolete over a greater anterior portion. The femoral granules are typically of two disparate sizes with the largest subequal in size to the largest pronotal granules; the largest femoral and pronotal granules are distinctly larger and more numerous than those on adults of *S. sinuata* and *S. xylonastis*. The elytra most frequently have narrow maculae. For *S. xylonastis*, the combination of small pronotal and femoral granules, and very narrowly maculate or immaculate elytra (rarely vittate), are good characters; dark basomesal areas on the pronotum are not common. For *S. sinuata*, the pronotal and femoral granules are numerous, medium in size, and more raised, making the pronotal surface appear more rugged; there are no dark pronotal areas; the anterolateral margins are typically strongly divergent, more so than on the two new species. Elytral coloration is absent or consists of narrow, short maculae; strial punctures appear larger and deeper. These characters, along with the measurements listed in Tables 1 and 2, should easily identify most individuals of *S. lignicola* and *S. xylonastis*. Schmude and Hilsenhoff's revision will provide more detailed diagnoses.

Acknowledgments

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